MULTI-EVENT, MULTI-STRUCTURE EXPERIMENTAL VALIDATION OF HYSTERESIS LOOP ANALYSIS SHM

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Hysteresis loop
Obtaining the approximate hysteresis loop

\[
\int \int \ddot{x} \, dt
\]

Low-pass filter the acceleration record, double integrate and baseline correct (if required)

Approximate the restoring force/column shear force from the measured acceleration

\[
m\ddot{x}(t) + f(x, \dot{x}) = -ma(t)
\]

Measured Floor Acceleration

Approximated Displacement History

Approximated Hysteresis Loop
The Hysteresis loop represents linear or nonlinear load-deformation relationship of dynamic structural behaviors.

Relevant information such as linear or nonlinear behavior, structural stiffness, energy dissipation and degradation can be obtained from hysteresis loops to reflect the associated structural properties.
Experimental Validation of the Method

A 1/10 scaled 12-story single-bay RC structure

A 1/10 scaled 12-story two-bay RC structure

A Full Scale 3-story SMRF structure at E-Defense
Identification of a REAL Building over 6 Events

X - direction

Y - direction
Even more – response reproduction

Showing the ability to reproduce the measured response using a simple linear model with identified updated stiffness matrices over time.

Want to see more?

Poster Session Date: Tuesday, June 26
Poster Session Time: 5:15pm - 7:00pm
Presenter: Geoff Rodgers